In the Specification

Amendments to the specification are indicated in the attached "Marked Up Version of Amendments" (pages 12-15).

Please replace the paragraph starting at page 11, line 17 and ending on page 12, line 2 with the following paragraph:

Figure 2 is a diagram illustrating another preferred embodiment of a sonar beamforming system 40 in accordance with the present invention. This system 40 includes a forward-looking sonar 44 having forward-looking sonar transmit beams 48 and forward-looking sonar receive beams 50. In addition, the system 40 has two side scan sonars 46 having side-looking sonar transmit beams 52. Further acoustic communication devices 54 which are preferably steerable are also present in this preferred embodiment of the system. At least one identification sonar 60 or a downward-looking Bathymetric Sonar is also mounted on the underside of the vehicle that transmits beam 58 and receives beams 56. This Bathymetric sonar 60 is a downward-looking sonar (DLS) for high-resolution terrain mapping and object identification.

Please replace the paragraph starting at page 12, line 16 and ending on page 13, line 6 with the following paragraph:

Figure 3 is a block diagram illustrating an electronic focusing sonar imaging system 70 in accordance with a preferred embodiment of the present invention. Signals such as transducer signal 74 and output signals 76 form the input to a low noise preamplifier 72 having time-gain control. The output of the preamplifier 72 forms the input into a sampling subsystem 80. The output of the sampler forms the input to programmable delays 82 associated with beamsteering and focusing functions, the output of which forms an input into a weighting subsystem 84. The outputs of the weighting function are then summed in a summer 86. In a preferred embodiment the sampler 80, the programmable delays 82, the weighting function 84 and summer 86 functions are integrated on a single chip 78 which accomplishes beamforming, preferably using a charge-domain-processing (CDP) structure. A preferred implementation of a beamforming device using CDP technology, including a programmable tapped delay line structure, is described in a co-pending PCT International Application Number

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PCT/US98/02291, filed on 3 February 1998, by Jeffrey Gilbert, Alice Chiang, and Steven Broadstone, the entire contents of which is hereby incorporated by reference.

Please replace the paragraph on page 14, lines 3 through 22 with the following paragraph:

The front-end 102 of the system 100 is an integration of many subsystems. A waveform transmit function 112 forms an input to a transmitter 114 which in turn transmits waveforms to a target image 106. An array 116 is received at the front-end 102 from the target image and is then processed in the front-end. The array in a preferred embodiment is a one-dimensional array. The processing signals of the received array begins with preamplification in a low noise preamplifier 118 having time-gain control. The output of the preamplifier 118 forms the input into a beamforming function 124, preferably using CDP. A memory device 122 interfaces with the preamplifier 118 and the beamformer 124. The memory device 122 may be a single memory device or plurality of memory devices. Such a memory device may be, but is not limited to, a random access memory, read-only memory, floppy disk memory, hard drive memory, extended memory, magnetic tape memory, zip drive memory and/or any device that stores digital information. A front-end host interface processing module or controller 120 interfaces with the memory 122. The controller 120 may be a single processing device or a plurality of processing devices. Such a processing device may be a microprocessor, microcomputer, digital signal processor, central processing unit of a computer or work station, digital circuitry, state machine, and/or any device that manipulates signals, for example, analog and/or digital, based on operational instructions. It should be noted that when the processing module implements one or more functions, via a state machine or logic circuitry, the memory storing the corresponding operational instructions is embedded within the circuitry comprising the state machine or logic circuitry. A standard interface such as, for example, a high-speed serial bus IEEE 1394/FireWire® chip set 126 interfaces with both the host interface controller 120 and the memory 122.

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Please replace the paragraph on page 15, lines 9 through 16 with the following paragraph:

The back-end 104 includes a microprocessor 130 that sends inputs to an Interface chip (IEEE 1394) 134 and then to a buffer 128 and a post signal processor 132. The FireWire® (IEEE 1394) chip set 126 in the front-end 102 interfaces with the interface chip set 134 in the back-end through an interface 110. The back-end preferably includes a receiving parallel data bus interface, for example, PCI or a serial bus interface, for example, a FireWire® chip set 134. The buffer 128 interfaces with the post signal processor 132. Further details regarding interface structure can be found in U.S. Application No. 09/791,491 filed on February 22, 2001, the entire contents of which is incorporated herein by reference.

Please replace the paragraph starting at page 15, line 21 and ending on page 16, line 8 with the following paragraph:

Figure 5 is a block diagram illustrating a flow chart of the image fusion process 150 of the sonar imaging system in accordance with a preferred embodiment of the present invention. Data from at least one side scan 152 are meshed with forward scan 152, 154 data 156 derived from a forward-looking scan such as described with respect to Figures 1 and 2. This data from the side scan and the forward scan are first normalized or scaled in a normalizing process 158. The process of normalization addresses spatial resolution. This normalization process is preferably performed, without limitation, on a standard personal computer platform. The fan shaped data is then meshed in an image fusion process 160. The data fusion process enables multi-sensor target classification and identification. The data fusion process may be accomplished, without limitation, using commercial products which provide three-dimensional rendering of data that is stacked such as, for example, 3D EchoTech that is provided commercially by EchoTech.

Please replace the paragraph on page 16, lines 13 through 15 with the following paragraph:

Figure 7 is a graphical illustration 190 of a curvilinear array of a sonar imaging system in accordance with a preferred embodiment of the present invention. An ultrasound absorbent backing layer 192 is used to generate a transducer frequency response with a wide bandwidth. The curvilinear array has a plurality of ultrasound